

CLAIMS

1. A method of measuring moisture content, comprising the following:
using a microwave cavity resonator that is provided with two holed iris
5 plates which are arranged vertically in the direction of a tube axis at mid points
of a wave guide, a portion between the iris plates forming a resonator portion
and the outside of each of the iris plates forming traveling wave portions, and
with a slit in which a specimen is disposed being placed in a manner so as to
cross the resonator portion;

10 setting a measuring frequency in a predetermined range between 1 to 25
GHz; and

measuring the moisture content or the moisture percentage of the
specimen based upon a difference in resonance peak level between cases when
the specimen is not present in the slit and the specimen is present in the slit.

15 2. The method of measuring moisture content according to claim 1,
wherein the moisture percentage of the specimen is determined based upon a
value obtained by dividing the difference in resonance peak levels between the
presence and absence of the specimen by a difference in resonance frequency
20 between the presence and absence of the specimen.

3. The method of measuring moisture content according to claim 1,
wherein:

measurements are carried out on a specimen of a film substrate bearing a
25 coat layer on the surface thereof as well as on a specimen of a film substrate
without the coat layer; and

the moisture content or the moisture percentage of only the coat layer is
determined by subtracting the measured value of the specimen without the
coat layer from the measured value of the specimen with the coat layer.

4. The method of measuring moisture content according to claim 1,
wherein:

measurements are carried out on a specimen of a film substrate bearing a plurality of coat layers laminated on the surface thereof as well as on a
5 specimen of a film substrate bearing coat layers except for the outermost coat layer of the coat layers; and

the moisture content or the moisture percentage of only the outermost coat layer is determined by subtracting the measured value of the specimen without the outermost coat layer of the coat layers from the measured value of
10 the specimen with the plurality of coat layers.

5. The method of measuring moisture content according to any of claims 1 to 4, wherein,

measuring a temperature dependency of the resonance peak level
15 preliminarily,

detecting a temperature of the microwave cavity resonator, a temperature of the surroundings of the slit or a temperature of the specimen when measuring the specimen, and

correcting the measured resonance peak level value based upon the
20 temperature dependency by using the detected temperature.

6. A moisture content measuring device comprising:

a microwave cavity resonator that is provided with two holed iris plates which are arranged vertically in the direction of a tube axis at mid points of a
25 wave guide, a portion between the iris plates forming a resonator portion and the outside of each of the iris plates forming traveling wave portions, and with a slit in which a specimen is disposed being placed in a manner so as to cross the resonator portion;

a microwave sweep oscillator which is connected to one of the pair of
30 traveling wave portions and oscillates at a frequency in a predetermined range

between 1 to 25 GHz;

a microwave intensity receiver that is connected to the other of the pair of traveling wave portions; and

a data processing device which, upon receipt of a signal from the
5 microwave intensity receiver, detects a peak level, and determines the moisture content or the moisture percentage of a specimen based upon a difference in resonance peak level between cases when the specimen is not present in the slit and the specimen is present in the slit.

10 7. The moisture content measuring device according to claim 6, wherein the microwave cavity resonator has the holes of the iris plates placed on the tube axes, with a diameter thereof being set to 1.0 to 20 mm.

15 8. The moisture content measuring device according to claim 6, wherein the resonator portion of the microwave cavity resonator has a dimension that is set to TE_{10n} ($n = 1, 2, 3, \dots$) in a resonance mode, with the slit being placed at a position that forms the maximum value in a electric field vector.

20 9. The moisture content measuring device according to any of claims 6 to 8, wherein:

one of the paired traveling wave portions of the microwave cavity resonator is constituted by a wave guide portion adjacent to one of the iris plates and another wave guide portion, connected to this wave guide portion, to which the microwave sweep oscillator is connected, and
25 the other traveling wave portion is constituted by a wave guide portion adjacent to the other iris plate and another wave guide portion, connected to this wave guide portion, to which the microwave intensity receiver is connected.

30 10. The moisture content measuring device according to any of claims 6 to 9, wherein both the wave guide to which the microwave sweep oscillator is

connected and the wave guide to which the microwave intensity receiver is connected are prepared as a coaxial wave guide converter with a one-sided flange.

5 11. The moisture content measuring device according to any of claims 6 to 10, wherein,

 the data processing device further detects a resonance frequency upon receipt of a signal from the microwave intensity receiver and determines the moisture percentage of the specimen based upon a value obtained by dividing
10 the difference in resonance peak level between the presence and absence of the specimen by a difference in resonance frequency between the presence and absence of the specimen.

 12. The moisture content measuring device according to any of claims 6 to 11, further comprising:

 a specimen supplying mechanism that continuously supplies a specimen to the slit of the microwave cavity resonator,

 wherein the data processing device further comprises a storage unit that stores a resonance peak level value when no specimen is present in the slit or a
20 resonance frequency value in addition to the resonance peak level value, and determines a moisture content or a moisture percentage of the specimen by using a measured value upon presence of the specimen in the slit and a value upon absence of the specimen in the slit that is stored in the storage unit,

 whereby an on-line measuring device that continuously measures the
25 specimen is formed.

 13. The moisture content measuring device according to claim 12, further comprising:

 a temperature dependency value storage unit that stores a preliminarily
30 measured temperature dependency of the resonance peak level; and

a temperature sensor which detects a temperature of the microwave cavity resonator, a temperature of the surroundings of the slit and a temperature of the specimen when measuring the specimen,

wherein, the data processing device further comprises a correction means
5 that corrects the resonance peak level measured value based upon the temperature dependency stored in the temperature dependency value storage unit by using the detected temperature from the temperature sensor.

14. The moisture content measuring device according to claim 12 or
10 claim 13, wherein a guide that has a shape for guiding the specimen to the slit is attached to an end portion of the slit side on the outside face of an E face of the wave guide of the microwave cavity resonator.

15. The moisture content measuring device according to any of claims
15 12 to 14, further comprising:

proximity sensors that are placed in the vicinity of the slit at opposing positions with respective gaps to the surface and rear face of the specimen that passes through the slit; and

a fluctuation detecting unit that detects a fluctuation of the specimen
20 passing through the slit based on a detected values of the proximity sensors.

16. The moisture content measuring device according to claim 15,
further comprising:

a save mechanism that keeps away the microwave cavity resonator from
25 the specimen when a fluctuation width detected by the fluctuation detecting unit exceeds a predetermined reference value.